



Washing Water Lesson Plan

Description:

Working in small groups, students will design, construct, and test a filter to change the quality of water treated at a local wastewater treatment plant.

Preliminary Questions:

1. Why is it important to treat water before sending it into our local waterways?
2. What are some ways a filter can improve water quality?
3. What do pH, dissolved oxygen, and turbidity tell us about water quality? Abbreviated version: what do pH, turbidity, and chlorine tell us about water quality?

Supplies:

Filter material:

- Coarse sand
- Fine sand
- Large gravel
- Small gravel
- Mesh Cotton
- Activated charcoal
- Baking soda
- Carbon filter
- Screen
- ¼ cup measurers
- Filter material labels

Filter apparatus:

- Empty 1L soda bottles
- Rubber bands
- Weed block fabric

Polluted source water:

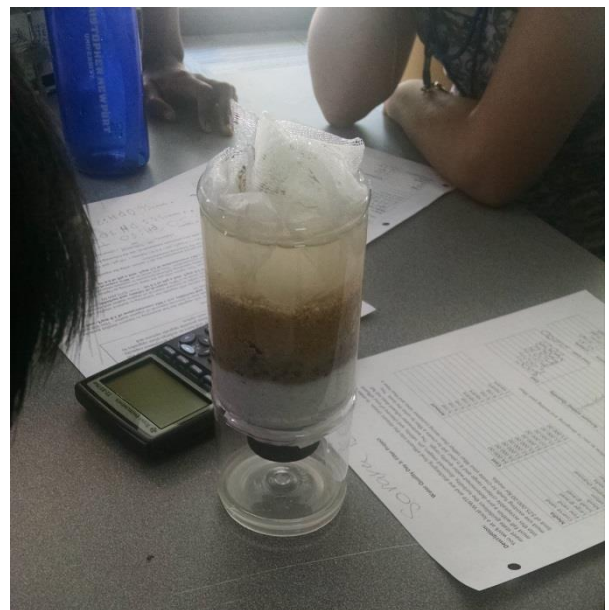
- Empty plastic container (2L soda bottle, milk jug, etc.)
- Water (2L)
- Dirt, mulch and/or leaves
- Bleach
- Salt
- Lemon juice

Water quality monitoring tools:

- Hydrometer
- pH strips
- Chlorine test strips

Miscellaneous:

- Paper towels
- Small clear cups
- Stirring sticks



Procedure/Instructional Strategies:

Preparation:

- 1) Prepare the filter apparatus. Cut a 1L bottle in half- the top portion will become the filter and the bottom portion will become the base. Remove the cap from the top portion. Wrap weed block fabric around the spout and secure it with a rubber band. Place the top portion into the base spout-side-down.
 - a) You have created one filter apparatus. This step should be repeated based on class size and should be done ahead of time. The apparatus can be rinsed and reused for future classes.
- 2) Set up multiple testing stations accommodating three to four students each. Include paper towels, one filter apparatus, 3-4 handouts, one small clear cup, a stirring stick, a hydrometer, pH strips, and chlorine test strips.
- 3) Set up a filter material “bar” in a centralized location. Separate the materials into individual containers and place a label in front of each.
- 4) Prepare the “dirty water.” Add one drop of bleach, $\frac{1}{4}$ cup of lemon juice, a handful of crushed brown leaves/dirt/mulch, and 1 tsp of salt to an empty 2L plastic container. Fill the remainder of the bottle with water and shake vigorously.



Classroom Procedure:

1. After answering the worksheet pre-questions, instruct each group to design a water filter using the filter materials provided and a budget of \$25,000.00.
 - a. Since students will have two trial opportunities, encourage them to not spend all of their budgets during trial 1. They can use their remaining funds in trial 2 to **add** material to their existing filter assemblies to improve their results.
2. Once students have designed their filters, allow representatives from each group to build them at the material “bar”. You may allow students to pour and measure the materials themselves, or an instructor may assist to avoid time delays and spills.
3. Provide each group with one cupful of “dirty” water. Shake vigorously prior to pouring. Instruct students to place their filters into their bases and pour the water on top. After all of the water has flowed through, they may analyze their finished water using the test strips at their stations.
4. If students have not met the water quality criteria, allow them to use their remaining money to add more materials to their filters in Trial 2 and repeat Step 3.
5. Complete the worksheet follow-up questions.

Follow-Up Questions:

1. Did your filtered water look different from your “dirty” sample?
2. Were you able to successfully meet all of the water quality criteria? Is there anything you would do differently?
3. How are planning, trial-and-error, and budgeting important?